

Indicator: Asthma Mortality and Prevalence (081 and 082)

Asthma is a chronic respiratory disease characterized by inflammation of the airways and lungs. During an asthma attack, the airways that carry air to the lungs are constricted, and as a result, less air is able to flow in and out of the lungs (NHLBI, 2004). Asthma attacks can cause a multitude of symptoms ranging in severity from mild to life-threatening. These symptoms include wheezing, breathlessness, chest tightness, and coughing (NHLBI, 2004). Family history of asthma contributes to susceptibility, but mostly, it is unknown what causes the development of asthma. Environmental exposures such as environmental tobacco smoke, dust mites, cockroach allergen, outdoor air pollution, pets, and mold are considered important triggers of an asthma attack (CDC, 2005).

For this indicator, asthma diagnosis is defined as the number of people who reported that they had ever been told by a doctor, nurse, or other health practitioner that they have asthma (i.e., lifetime asthma prevalence). An asthma attack is defined as the number of people who reported an asthma episode or attack in the past 12 months (CDC, 1999; 2000; 2001). The diagnosis of lifetime asthma prevalence is based on national estimates from the National Health Interview Survey (NHIS). The NHIS is a cross-sectional household interview survey. The sampling plan follows a multistage area probability design that permits the representative sampling of households in the U.S. The survey is designed so that the sample scheduled for each week is representative of the target population, and the weekly samples are additive over time. The response rate for the ongoing portion of the survey (core) has been between 94 and 98 percent over the years. NHIS has been conducted continuously since 1957. Asthma mortality rates are based on underlying cause-of-death as entered on a death certificate by a physician and recorded in the National Vital Statistics System (NVSS) which registers virtually all deaths nationwide. The temporal coverage of the data is from 1933 to present and data are collected from all 50 states and the District of Columbia. Data are presented as age-adjusted rates, and asthma death rates are reported nationally and by EPA Region.

What the Data Show

Figure 081 presents the overall trends in asthma mortality (all ages) for the U.S. and the 10 EPA Regions for the time periods 1979-1998 and 1999-2001. Between 1979 and 1998, overall age-adjusted rates (2000 U.S. Standard Population) ranged between a low of 1.3 per 100,000 (1979) to a high of 2.2 per 100,000 (1994,1995,1996). In 2002, 4,261 people died from asthma with an age-adjusted rate (2000 U.S. Standard Population) of 1.5 per 100,000. Between 1979 and 1998, the age-adjusted (2000 U.S. Standard Population) asthma mortality rates varied only a small amount between each of the 10 EPA Regions (e.g., a high of 3.0 per 100,000 in both 1988 [Region 8] and 1989 [Region 8] to a low of 1.1 per 100,000 in 1979 [Region 3] and again in 1982 [Region 1]). In 2001, the rates ranged from 1.2 (Region 1) to 1.8 (Region 8) per 100,000.

In 2002, approximately 30.8 million people were reported as having been diagnosed with asthma over their lifetime (CDC, 2002). Figure 082-1 provides the estimated asthma diagnosis prevalence for adults aged 18 years and older between 1997-2002. Generally, the rates increased between 1997 and 2002 with age-adjusted (2000 U.S. Standard Population) prevalences rising from 90.3 per 1,000 in 1997 to 106.5 per 1,000 in 2002. During this same time period, prevalence was consistently higher among females (range 98 – 122.6 per 1,000) than males (range 70.5 – 92.7 per 1,000).

The lifetime asthma prevalence has been increasing over time for all age groups (Figure 082-2). For each adult age category, the prevalence has increased between 1997 and 2002. In 1997 the ever diagnosed with asthma prevalence was 99.1 (ages 18-44 years), 97.2 (ages 45-64 years), 71.3 (ages 65-74 years), and 51.9 (ages 75+ years) per 1,000 population compared to rates in 2002 at 115.2 (ages 18-44 years), 105.7 (ages 45-64), 83.5 (ages 65-74 years), and 75.4 (ages 75+ years) per 1,000 population. In 2002, the

reported age-adjusted (U.S. Standard Population) asthma attack prevalence among adults aged 18 and older was 68 per 1,000 and the attack rate was higher among Blacks (80 per 1,000) than Whites (67 per 1,000) (CDC, 2002).

Indicator Limitations

- Asthma mortality rates are based on underlying cause-of-death as entered on a death certificate by a physician. Some individuals may have had competing causes of death. “When more than one cause or condition is entered by the physician, the underlying cause is determined by the sequence of conditions on the certificate, provisions of the ICD, and associated selection rules and modifications” (CDC WONDER). Consequently, some misclassification of reported asthma-related mortality might occur in individuals with competing causes of death.
- In ROE03, prevalence was defined as the number of people who reported an asthma episode or attack in the past 12 months. However, recently updated statistics using these criteria for the years 1999–2001 are only available for children ages 0–17 years (see indicator for childhood asthma).
- For the years 1979, 1981–1989, and 2001, if the user selects a CDC WONDER query for the United States with data grouped by state, or selects a WONDER query for a specific state, CDC WONDER reports state population figures that do not add up to the national population reported by CDC WONDER. This is because the two different sets of populations come from different U.S. Census population estimates. (For all other years, these two sets of population data are the same.)
- The International Classification of Diseases 9th Revision (ICD-9) codes were used to specify underlying cause of death for years 1979–1998. Beginning in 1999, cause of death is specified with the International Classification of Diseases 10th Revision (ICD-10) codes. The two revisions differ substantially, and to prevent confusion about the significance of any specific disease code, data queries are separate.

Data Sources

Mortality:

CDC. CDC WONDER. Compressed Mortality File, Underlying Cause of Death. <http://wonder.cdc.gov>. The complete web-link pathway from the CDC WONDER Home Page is:

-> [Mortality—underlying cause of death](#) -> [Mortality for 1999–2001 with ICD 10 codes](#).

Note: ICD-9 code 493; ICD-10 codes J45–J46 are listed as asthma. The raw numbers for each state were downloaded from the CDC WONDER mortality database (<http://wonder.cdc.gov>). The raw numbers for each state within a region were combined and age-adjusted rates (2000 U.S. Standard Population) were calculated.

NCHS. National Vital Statistics Reports, 53(5): Deaths: Final Data for 2002. October 12, 2004. Available at: http://www.cdc.gov/nchs/data/nvsr/nvsr53_05.pdf.

Prevalence:

CDC, National Center for Health Statistics (NCHS), Series 10: Summary Health Statistics for U.S.

Children: National Health Interview Survey, 1999 (Report 210); 2000 (Report 213); 2001 (Report 216); 2002 (Report 221). <http://www.cdc.gov/nchs/products/pubs/pubd/series/sr10/ser10.htm>. See Table 1.

NCHS: Summary Health Statistics for U.S. Adults: National Health Interview Survey, 1999 (Report 212); 2000 (Report 215); 2001 (Report 218).

<http://www.cdc.gov/nchs/products/pubs/pubd/series/sr10/ser10.htm>. See Table 3.

References

CDC, National Center for Health Statistics (NCHS), Series 10: Summary Health Statistics for U.S. Children: National Health Interview Survey, 1999 (Report 210); 2000 (Report 213); 2001 (Report 216); 2002 (Report 221). <http://www.cdc.gov/nchs/products/pubs/pubd/series/sr10/ser10.htm>. See Table 1.

Center for Disease Control and Prevention (CDC). 2005. Basic Facts about Asthma. Accessed February 3, 2005. <http://www.cdc.gov/asthma/faqs.htm>

National Center for Health Statistics (NCHS). 2004. Health, United States, 2004 with Chartbook on Trends in the Health of Americans. Hyattsville, Maryland

National Heart, Lung, and Blood Institute (NHLBI). 2004. Diseases and Conditions Index. Accessed November 12, 2004. http://www.nhlbi.nih.gov/health/dci/Diseases/Asthma/Asthma_WhatIs.html

Graphics

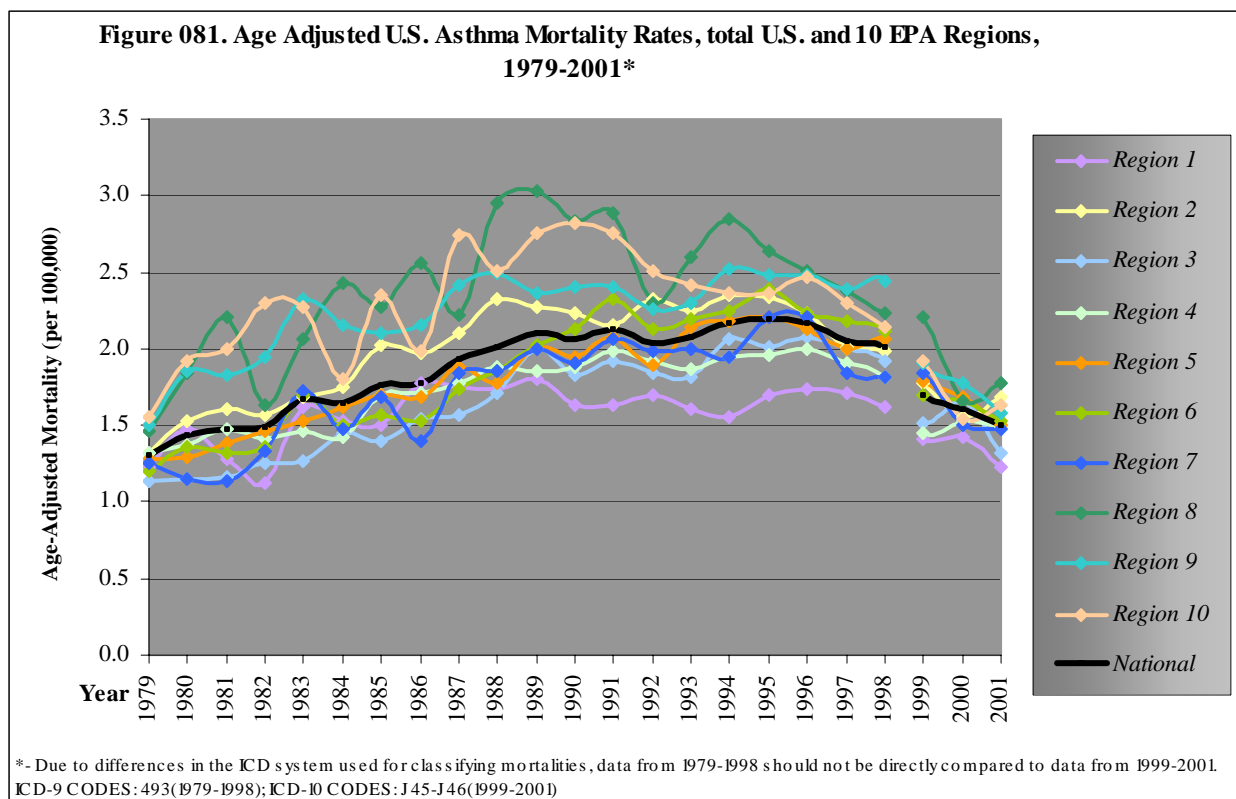
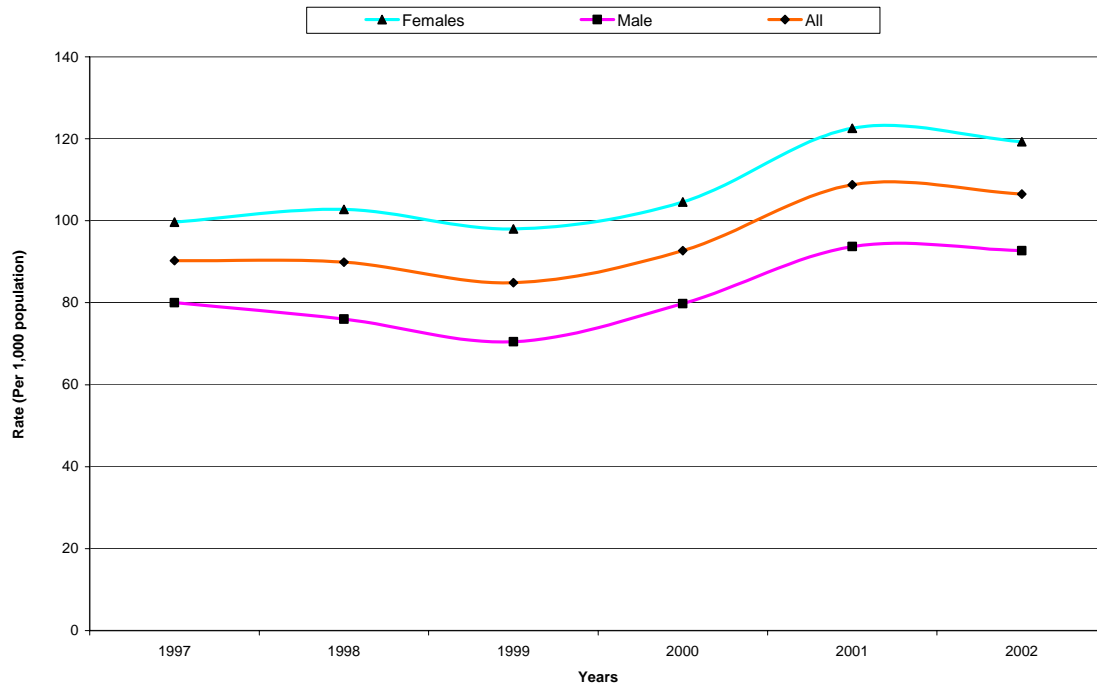
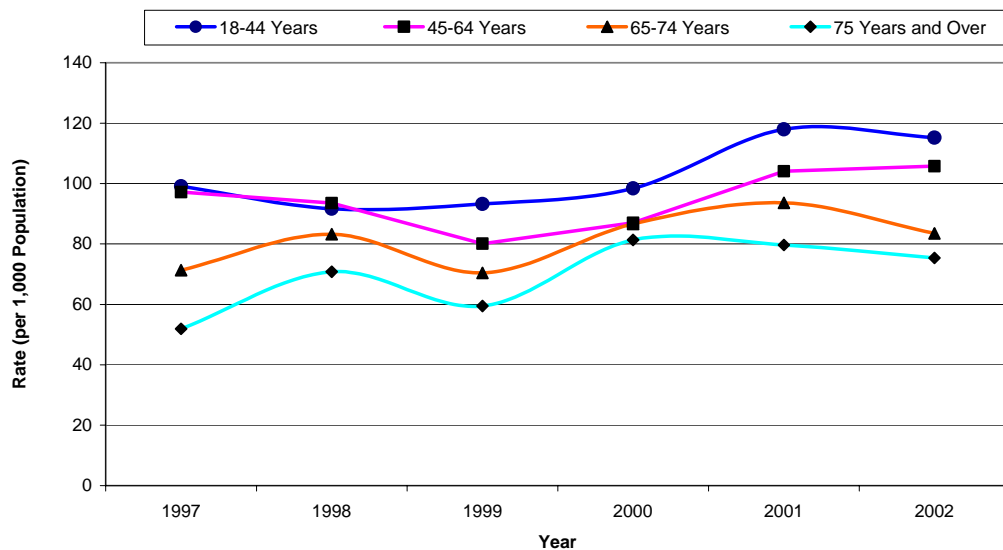


Figure 082-1: Estimated Prevalence Rate of U.S. Population aged 18 and Older "Ever" Reported Having Asthma



Source: NCHS: Summary Health Statistics for U.S. Adults: National Health Interview Survey, 1999 (Report 212), 2000 (Report 215), 2001 (Report 218), 2002 (Report 222).
<http://www.cdc.gov/nchs/products/pubs/pubd/series/sr10/ser10.htm>. See Table 3.

Figure 082-2 Estimated Prevalence Rate of U.S. Population aged 18 and Older "Ever" Reported Having Asthma



Source: NCHS: Summary Health Statistics for U.S. Adults: National Health Interview Survey, 1999 (Report 212), 2000 (Report 215), 2001 (Report 218), 2002 (Report 222).
<http://www.cdc.gov/nchs/products/pubs/pubd/series/sr10/ser10.htm>. See Table 3.

R.O.E. Indicator QA/QC

Data Set Name: ASTHMA PREVALENCE & MORTALITY

Indicator Number: 081 (89113)

Data Set Source: CDC, NCHS; CDC, NHIS

Data Collection Date: ongoing

Data Collection Frequency: yearly

Data Set Description: Asthma Prevalence & Mortality (combines former 081 & 082)

Primary ROE Question: What are the trends in human disease and conditions for which environmental pollutants are thought to be to risk factors including across population subgroups and geographic regions?

Question/Response

T1Q1 Are the physical, chemical, or biological measurements upon which this indicator is based widely accepted as scientifically and technically valid?

Yes. Mortality: The National Vital Statistics System (NVSS) is the oldest and most successful example of inter-governmental data sharing in Public Health and the shared relationships, standards, and procedures form the mechanism by which NCHS collects and disseminates the Nation's official vital statistics. The methodology for collecting vital statistics is standardized and outlined in Model State Vital Statistics Act and Regulations Revised April 1995, DHHS publication (PHS) 95-1115 (<http://www.cdc.gov/nchs/data/misc/mvsact92aacc.pdf>) Prevalence:

Asthma prevalence is measured as a question on the National Health Interview Study (NHIS) through the Centers for Disease Control. The NHIS is the principal source of information on the health of the civilian noninstitutionalized population of the United States and is one of the major data collection programs of the National Center for Health Statistics (NCHS). Complete program methodology can be found at: <http://www.cdc.gov/nchs/about/major/nhis/hisdesc.htm> and <http://www.cdc.gov/nchs/about/major/nhis/methods.htm>. Prevalence: Asthma prevalence is measured as a question on the National Health Interview Study (NHIS) through the Centers for Disease Control. The NHIS is the principal source of information on the health of the civilian noninstitutionalized population of the United States and is one of the major data collection programs of the National Center for Health Statistics (NCHS). Complete program methodology can be found at: <http://www.cdc.gov/nchs/about/major/nhis/hisdesc.htm> and <http://www.cdc.gov/nchs/about/major/nhis/methods.htm>.

T1Q2 Is the sampling design and/or monitoring plan used to collect the data over time and space based on sound scientific principles?

Mortality: Yes. The National Vital Statistics System is responsible for the Nation's official vital statistics. These vital statistics are provided through State-operated registration systems. Standard forms for the collection of data and model procedures for the uniform registration of the events are developed and recommended for State use through cooperative activities of the States and the NCHS (<http://www.cdc.gov/nchs/data/dvs/DEATH11-03final-ACC.pdf>). U.S. Standard Death Certificates are revised periodically. Most state certificates conform closely in content and arrangement to the standard certificate recommended by NCHS and all certificates contain a minimum data set specified by NCHS. Demographic information on the death certificate is provided by the funeral director based on information supplied by an informant. A physician, medical examiner, or coroner provides medical certification of cause of death. Prevalence: The National Health Interview Survey is a cross-sectional household interview survey. Sampling and interviewing are continuous throughout each year. The sampling plan follows a multistage area probability design that permits the representative sampling of households. The sampling plan was redesigned in 1995 to include the oversampling of both Black persons and Hispanic persons, and to draw samples from each state. Although the NHIS sample is too small to provide State level data with acceptable precision for each State, this design will facilitate the use of NHIS data with State-level telephone health surveys. In 1997 the collection methodology changed from paper and pencil questionnaires to computer-assisted personal interviewing (CAPI). The NHIS questionnaire was also revised extensively in 1997. In some instances, basic concepts measured in NHIS changed and in other instances the same concepts were measured in a different way. While some questions remain the same over time, they may be preceded by different questions or topics. For some questions, there was a change in the reference period for reporting an event or condition. Because of the extensive redesign of the questionnaire in 1997 and introduction of the CAPI method of data collection, data from 1997 and later years may not be comparable with earlier years.

T1Q3 Is the conceptual model used to transform these measurements into an indicator widely accepted as a scientifically sound representation of the phenomenon it indicates?

Mortality: Yes. The data collected by NVSS are routinely referenced and used in epidemiological studies. Regional Mortality: Mortality rates age-adjusted for the 2000 U.S. standard population (rates per 100,000) for the years 1979 through 2001 were compiled through use of CDC WONDER. See attached file, age-adjusted regional rates.doc, for more information on the calculation of rates. Prevalence: The NHIS is one of the principal sources of information on the health of the civilian noninstitutionalized population of the United States.

T2Q1 To what extent is the indicator sampling design and monitoring plan appropriate for answering the relevant question in the ROE?

Mortality: Virtually all deaths are registered with the NVSS nationwide. The temporal coverage of the data is from 1933 to present. Data are collected from all 50 States including the District of Columbia. Prevalence: The sample design plan of NHIS follows a multistage probability design that permits a continuous sampling of the civilian noninstitutionalized population residing in the United States. The survey is designed in such a way that the sample scheduled for each week is representative of the target population, and the weekly samples are additive over time. The response rate for the ongoing portion of the survey (core) has been between 94 and 98 percent over the years. Response rates for special health topics (supplements) have generally been lower.

T2Q2 To what extent does the sampling design represent sensitive populations or ecosystems?

Mortality: The data set has nationwide death reporting, including sensitive populations. Prevalence: The sample design plan of NHIS follows a multistage probability design that permits a continuous sampling of the civilian noninstitutionalized population residing in the United States. The survey is designed in such a way that the sample scheduled for each week is representative of the target population, and the weekly samples are additive over time. The response rate for the ongoing portion of the survey (core) has been between 94 and 98 percent over the years. Response rates for special health topics (supplements) have generally been lower.

T2Q3 Are there established reference points, thresholds or ranges of values for this indicator that unambiguously reflect the state of the environment?

Not applicable

T3Q1 What documentation clearly and completely describes the underlying sampling and analytical procedures used?

Mortality: The sampling and quality assurance information can be found in Model State Vital Statistics Act and Regulations Revised April 1995, DHHS publication (PHS) 95-1115 (<http://www.cdc.gov/nchs/data/misc/mvsact92aacc.pdf>). Documentation is also available at <http://wonder.cdc.gov/wonder/help/mort.html> Source of data for Table HH2: Source: CDC. CDC WONDER. Compressed Mortality File, Underlying Cause of Death. <http://wonder.cdc.gov>. The complete web-link pathway from the CDC WONDER Home Page is: à Mortality underlying cause of death à Mortality for 1999 2001 with ICD 10 codes For 2002 data: National Center for Health Statistics (NCHS). 2004. Deaths Final Data 2002. National Vital Statistics vol 53 no. 5 http://www.cdc.gov/nchs/data/nvsr/nvsr53/nvsr53_05.pdf Regional Mortality: Mortality rates age-adjusted for the 2000 U.S. standard population (rates per 100,000) for the years 1979 through 2001 were compiled through use of CDC WONDER. See attached file, age-adjusted regional rates.doc , for more information on the calculation of rates. Prevalence: Methodology for collection and analysis of NHIS data can be found at: <http://www.cdc.gov/nchs/about/major/nhis/methods.htm> and http://www.cdc.gov/nchs/data/series/sr_02/sr02_130.pdf. Source of data for Table HH2: CDC, National Center for Health Statistics (NCHS), Series 10: Summary Health Statistics for U.S. Children: National Health Interview Survey, 1999 (Report 210); 2000 (Report 213); 2001 (Report 216). <http://www.cdc.gov/nchs/products/pubs/pubd/series/sr10/ser10.htm>. See Table 1. NCHS: Summary Health Statistics for U.S. Adults: National Health Interview Survey, 1999 (Report 212),

2000 (Report 215), 2001 (Report 218).

<http://www.cdc.gov/nchs/products/pubs/pubd/series/sr10/ser10.htm>. See Table 3.

- T3Q2** Is the complete data set accessible, including metadata, data-dictionaries and embedded definitions or are there confidentiality issues that may limit accessibility to the complete data set?

Mortality: The data can be accessed up to the county level through the electronic data warehouse for CDC at <http://wonder.cdc.gov> Individual level data are not available due to confidentiality issues. Prevalence: Data sets and accompanying documentation from 1992 through 2002 are available at: http://www.cdc.gov/nchs/about/major/nhis/quest_data_related_doc.htm

- T3Q3** Are the descriptions of the study or survey design clear, complete and sufficient to enable the study or survey to be reproduced?

Mortality: Yes. Virtually all deaths from the 50 states, including District of Columbia, submit mortality data to the NVSS at NCHS. The recommended certificate of death is posted at <http://www.cdc.gov/nchs/data/dvs/DEATH11-03final-ACC.pdf> The documentation for the mortality data set is <http://wonder.cdc.gov/wonder/help/mort.html> Prevalence: Questionnaires from the survey at various points of time are posted on the NHIS website: http://www.cdc.gov/nchs/about/major/nhis/quest_data_related_doc.htm. This study is an ongoing study.

- T3Q4** To what extent are the procedures for quality assurance and quality control of the data documented and accessible?

Mortality: See answer to T3Q1 Prevalence: Quality assurance and quality control is provided in the document Design and Estimation for the National Health Interview Survey, 1995-2004 (http://www.cdc.gov/nchs/data/series/sr_02/sr02_130.pdf).

- T4Q1** Have appropriate statistical methods been used to generalize or portray data beyond the time or spatial locations where measurements were made (e.g., statistical survey inference, no generalization is possible)?

Prevalence: All Statistical methods used in evaluating the data set can be found at: <http://www.cdc.gov/nchs/about/major/nhis/methods.htm>.

- T4Q2** Are uncertainty measurements or estimates available for the indicator and/or the underlying data set?

Not applicable

- T4Q3** Do the uncertainty and variability impact the conclusions that can be inferred from the data and the utility of the indicator?

Not applicable

- T4Q4** Are there limitations, or gaps in the data that may mislead a user about fundamental trends in the indicator over space or time period for which data are available?

Mortality: The mortality data on the Compressed Mortality File at <http://wonder.cdc.gov/mortSQL.html> are based on records for all deaths occurring in the fifty

states and the District of Columbia. Deaths to foreign residents are excluded. Deaths to residents who died abroad are not included on this file. Asthma mortality rates are based on under-lying cause-of-death as entered on a death certificate by a physician. Some individuals may have had competing causes of death. When more than one cause or condition is entered by the physician, the underlying cause is determined by the sequence of conditions on the certificate, provisions of the ICD, and associated selection rules and modifications. (CDC WONDER database) The 2002 mortality rates were not yet available in CDC WONDER database at the time of this indicator write-up. The age-adjusted mortality rates were obtained through National Center for Health Statistics publication. For purposes of comparison, it should be noted that mortality rates reported by NCHS reports differ slightly from those rates reported by CDC WONDER. NCHS uses U.S. Census Bureau population estimates for all age groups; CDC WONDER uses birth certificate data for the Under 1 Year age group and uses U.S. Census Bureau population estimates for all other age groups. The International Classification of Diseases 9th Revision (ICD 9) codes are used to specify underlying cause of death for years 1979 - 1998. Beginning in 1999, cause of death is specified with the International Classification of Diseases 10th Revision (ICD 10) codes. The two revisions differ substantially, and to prevent confusion about the significance of any specific disease code, data queries are separate. Regional data: Mortality data are not available for the U.S. territories in CDC WONDER. Thus, Regions 2 and 9 are calculated to include only States. Note that for the years 1979, 1981-1989, and 2001, if the user selects a WONDER query for the United States with data grouped by state, or selects a WONDER query for a specific state, WONDER reports state population figures that do not add up to the national population reported by WONDER. This is because the two different sets of populations come from different U.S. Census population estimates. (For all other years, these two sets of population data are the same.) Prevalence: Persons excluded from this study are patients in long-term care facilities; persons on active duty with the Armed Forces (though their dependents are included); and U.S. nationals living in foreign countries. The response rate for the ongoing portion of the survey (core) has been between 94 and 98 percent over the years. Response rates for special health topics (supplements) have generally been lower. In the Draft Report on the Environment 2003, prevalence was reported based on episode of asthma attack during the preceding 12 months. Updates of these results were only available for children (see indicator for childhood asthma).

Calculation of Age-Adjusted Regional Mortality Rates Using State Data from CDC WONDER

Mortality rates age-adjusted for the 2000 U.S. standard population (rates per 100,000) for the years 1979 through 2001 were compiled as detailed below. (Mortality data for 2002 and later are not yet available through CDC WONDER.)

Identifying relevant data

- Each mortality indicator (e.g., cancer, cardiovascular disease, asthma) was reviewed based on EPA's 2003 Draft Report on the Environment and a National Center for Health Statistics (NCHS) report that discusses ICD (International Classification of Diseases) to obtain the ICD codes that describe each of these indicators. Due to a revision of the ICD system in 1999, ICD-9 codes were obtained for the years 1979-1998 and ICD-10 codes for the years 1999-2001.

Downloading and organizing the data

- Mortality data were accessed through CDC's WONDER database (<http://wonder.cdc.gov/>).
- We downloaded a file for each year that regional mortality indicators were requested (1979-2001) and saved these data into separate sheets in Microsoft Excel (one workbook for each indicator). Both raw and compiled data are presented in each of these Excel workbooks. For example, '1999D' is the sheet with the raw data for the year 1999 and '1999' is the sheet with the calculations for that year.
- The calculation worksheet is organized as follows:
 - The first table arranges the raw data by state and age group. For each age group and state, two numbers are presented: the mortality cases and the associated population.
 - The second table (Regional Breakdown) groups the mortality cases and populations for the 50 states plus Washington, D.C., into the ten EPA regions, to obtain the total cases and total population for each region, by age group. (For a map of the EPA regions, refer to <http://www.epa.gov/epahome/whereyou-live.htm>.)
 - The third table (Regional Breakdown [combine certain groups]) merges two sets of age groups with each other (5-9 years with 10-14 years; 15-19 years with 20-24 years) to match the age-adjustment methodology used to calculate age-adjusted mortality rates in CDC WONDER (see below).
 - The fourth table on the worksheet (Regional Breakdown [Computation of Age-Adjusted Rate Components]) presents the basic steps of calculating age-adjusted mortality rates for each region (see below).
 - The final table on the Excel sheet (Regional Summary) lists the age-adjusted rates for each region and for the entire US; these values are compiled into the summary sheet

that covers all regions for all years for an indicator, accompanied by a trend chart that graphically depicts the regional data.

Calculating age-adjusted regional rates

The steps followed in calculating age-adjusted regional rates are detailed below, followed by a sample calculation.

Step 1

Using the following equation, the *crude death (or mortality) rate* is obtained by dividing the mortality cases ($Cases_i$) by the population for that age group ($Population_i$), then by multiplying by 100,000 (to get the cases per 100,000). This is done for each age group within each region. (The “i” subscript is included to indicate that this calculation is performed for several age groups, i.e. $CrudeRate_{<1\text{ year}}$, $CrudeRate_{1-4\text{ years}}$, etc.)

$$CrudeRate_i = \frac{Cases_i}{Population_i} \times 100,000$$

Step 2

For each age group, the weighted age-adjusted factor is calculated, using 2000 U.S. standard population factors provided by NCHS (See Table 1 below). The age-specific crude death rate is multiplied by that age group’s standard population for the year 2000 (2000 Population_i), and then divided by the total standard population for the year 2000 ($2000\text{ Population}_{total}$). (For details on the standard population, see “Age-Adjustment of Death Rates” on the web page <http://wonder.cdc.gov/wonder/help/mort.html>¹).

$$WeightedFactor = CrudeRate \times \frac{2000Population_i}{2000Population_{total}}$$

Table 1. United States Standard Population*

Age	Number
Under 1 year	13,818
1-4 years	55,317
5-14 years	145,565
15-24 years	138,646
25-34 years	135,573
35-44 years	162,613
45-54 years	134,834
55-64 years	87,247
65-74 years	66,037
75-84 years	44,842
85 years and over	15,508
All ages	1,000,000

* Based on year 2000 projected population

¹ The source cited by CDC WONDER for the age-adjustment data is the following NCHS report: *Anderson RN, Rosenberg HM. Age standardization of death rates: Implementation of the year 2000 standard. National Vital Statistics Reports; Vol 47 No 3. Hyattsville, Maryland. National Center for Health Statistics. 1998.*

Step 3

The age-adjusted mortality rate is then obtained by adding together the individual weighted factors for each age group:

$$AgeAdjustedRate = \sum_i WeightedFactor_i$$

Sample Calculation

Table 2 (below) shows the output of a sample calculation of the age-adjusted mortality rate for cancer (across all age groups) in EPA Region 9 in 1982. (Note that we have presented this in a format that is not used in the Excel workbook, in order to illustrate the calculations for a single region. However, all of the steps and calculations are identical.)

For each age group, the number of mortality cases is the sum of the mortality cases for Arizona, California, Hawaii, and Nevada, for that age group in that year; the population is the sum of the populations of these same four states for that age group in that year. For example, for the 35-44 years age group, the number of cancer mortalities for these states are 112 (Arizona), 1,413 (California), 53 (Hawaii), and 55 (Nevada), with the sum equaling 1,633. Similarly, the population is the sum of the respective states 338,654 (Arizona), 3,152,885 (California), 124,743 (Hawaii), and 120,463 (Nevada), which equals 3,736,745. The crude rate (43.70) for this age group is therefore equal to the total number of mortality cases (1,633) divided by the total population (3,736,745), multiplied by 100,000.

Table 1. Cancer Mortality, All Age Groups, EPA Region 9, 1982.

Age Group (Years)	Mortality Cases	Year 1982 Population	Crude Death Rate	2000 Std. Population	Weighted Factor
<1 year	32	515,809	6.20	13,818	0.09
1- 4 years	108	1,824,635	5.92	55,317	0.33
5- 9 years	114	1,977,487	N/A		
10-14 years	94	2,188,828	N/A		
15-19 years	139	2,432,939	N/A		
20-24 years	180	2,884,175	N/A		
25-34 years	694	5,551,792	12.50	135,573	1.69
35-44 years	1,633	3,736,745	43.70	162,613	7.11
45-54 years	4,662	2,793,603	166.88	134,834	22.50
55-64 years	11,283	2,679,802	421.04	87,247	36.73
65-74 years	15,423	1,876,606	821.86	66,037	54.27
75-84 years	11,397	912,865	1248.49	44,842	55.98
85+ years	4,424	269,593	1640.99	15,508	25.45
Unknown	27	0	N/A	0	0
Total	50,210	29,644,879	N/A	1,000,000	N/A
Age-Adjusted Mortality Rate					205.7

As described above, the Weighted Factor is the Crude Death Rate multiplied by the 2000 Standard Population for that age group and divided by the total Standard Population (the total of the age-group populations). For example, the weighted factor for the 35-44 years age group is the crude rate (43.70) times the 2000 population for that group (162,613), divided by the total 2000 Standard Population (1,000,000), which equals 7.11. The 1982 Region 9 age-adjusted mortality rate, 205.7, is the sum of the weighted factors of all age groups.

Notes:

- For the 5-14 and 15-24 years categories it is necessary to merge two sets of age ranges to match the age-adjustment grouping used within WONDER.
- For mortality indicators that were also compiled for children (ages 0-19 years), we only used the data for the age groups 0-1, 1-4, 5-9, 10-14, and 15-19 years, and then we age-adjusted these data using a set of age-adjustment factors that only cover to age 19 years.
- For the file that compiles birth defect mortality rates, the only data used from CDC WONDER are for the <1 year age group, so the crude rate equals the age-adjusted rate.
- Although data were queried for individual states to compile regional data, we did this by querying data for the entire United States from the CDC WONDER system, and specifying that the data be grouped by age and by year. Due to a quirk of CDC WONDER, if the user selects a single state for a query (instead of the entire United States), the population data are taken from a different data source: there are small discrepancies between these numbers and so the state-specific query should not be used to verify these compiled data.